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BOY-GIRL DIFFERENCES IN PARENTAL TIME INVESTMENTS: EVIDENCE FROM THREE COUNTRIES

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Boy-Girl Differences in Parental Time Investments: Evidence from Three Countries
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ABSTRACT

We study differences in the time parents spend with boys and girls at preschool ages in Canada, the UK and the US. We refine previous evidence that fathers commit more time to boys, showing this greater commitment emerges with age and is not present for very young children. We next examine differences in specific parental teaching activities such as reading and the use of number and letters. We find the parents commit more of this time to girls, starting at ages as young as 9 months. We explore possible explanations of this greater commitment to girls including explicit parental preference and boy-girl differences in costs of these time inputs. Finally, we offer evidence that these differences in time inputs are important: in each country the boy-girl difference in inputs can account for a non-trivial proportion of the boy-girl difference in preschool reading and math scores.

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1.0 Introduction

Advances in brain science have provided new insights to the differential development of male and female cognitive and behavioral facilities due to both biological and environmental stimuli. At the same time, the emergent "boys crisis"—the apparent failure of boys to thrive at the primary, secondary and post-secondary educational levels—has heightened popular interest in this subject, and precipitated new paths for economic research in the area.[1] Parents' time is an input to children's human capital development, and recent research tells us parents' time inputs vary by the characteristics of parents and children.[2] In light of these developments, in this paper we investigate the girl-boy differences in parental time investments and their possible sources.

Indications of human capital differences by sex emerge at young ages. Some preliminary evidence of sex/gender differences in test scores and cognitive measures at the preschool level is presented in table 1.[3] We report the means of vocabulary and math test scores at ages 4 and 5 for girls and boys born in the 2000s in Canada, the United States and the United Kingdom. We also report a 'conditional difference,' estimated by ordinary least squares controlling for some standard observable characteristics (described below) and inferring the difference from an indicator variable for a male child. In almost all cases boys trail girls at the mean, with the gap ranging from 12% to 18% of a standard deviation. The emergence of this gender achievement gap at school entry is particularly salient given widespread agreement on the importance of early childhood experiences and investments to later life outcomes (e.g., Almond and Currie 2011).

[1] Halpern (2011) provides a review of recent research in brain science on sex differences in cognitive abilities. Rosin (2012) argues the hypothesis that societal norms have turned against males. Bertrand and Pan (2013) is an example of recent economic research on the failures males experience in the school years.
[2] Guryan et al. (2008), Ramey and Ramey (2012) and Sayer et al. (2004) study how parents' characteristics are associated with parental investments. Zick and Bryant (1996) and Price (2008) study how these investments vary by child characteristics.
[3] We use 'gender' in instances where we emphasize behavioral aspects and 'sex' where we emphasize biological aspects of differences across boys and girls.

We focus on differences in parents' time inputs by the sex of their child at the ages (0-4) leading up to these pre-school tests. The analysis proceeds in three steps. First, we document the differential parental treatment of boys and girls born in the 2000s in Canada, the United States and the United Kingdom. Second, we investigate some explanations for the sources of these differences in parental inputs. Third, we assess the potential consequences of these time input differences for the cognitive development of children at school entry.

The first step is to document the differences in parental time across boys and girls, building on and refining existing research. Previous evidence of differences in parents' aggregate time inputs indicates that boys receive more time due to the larger commitments of their fathers (Lundberg 2005b, Lundberg et al. 2007, Yeung et al. 2001). We begin our analysis re-evaluating this evidence using larger data sets that allow us to draw meaningful comparisons across children of different ages. The results lay the basis for our choice of sample for the rest of the study. We find that the increased time input of fathers emerges as children age. In the first years of life we find no evidence that fathers (or mothers) commit more total time to children of a specific gender.

One limitation of evidence based on aggregate time use is that aggregate time spent with children may not have a clear connection to the children's cognitive function. Drawing on data from Canada, the United States and the United Kingdom, we extend the literature by examining parental time spent in activities with a more direct link to cognitive development, such as reading and teaching new words and letters. These teaching activities have a clearer relationship with the cognitive skills that are typically evaluated by tests such as those reported in table 1, and are the specific targets of public campaigns to increase the time parents spend with their children.

In all three countries, starting as early as 9 months of age, we document systematic provision of higher amounts of these cognition-related time inputs to females. Parents spend more time with girls reading, telling stories, singing songs, drawing, and teaching new words and letters. The only activity for which there is some evidence of more equal provision is time spent exploring the use of numbers, although this is not true in all three countries.

In the second step of our analysis we evaluate evidence that attempts to distinguish between explanations of the differential treatment of boys and girls by parents. There are three general classes of explanations. One class is based in some intrinsic difference between boys and girls; a difference in the production function that turns parental time inputs into child outcomes. In the cognitive sphere these sorts of gender based differences are controversial. As discussed below, the evidence of a cognitive advantage for boys or girls in a particular aptitude is often equivocal. However, if inputs are processed into outcomes differently by boys and girls, parents may rationally choose different mixes of inputs in response.

A second class of explanations is based in parents' preferences. Here, the mapping of inputs into outcomes is the same for boys and girls, but parents make gender-differentiated input choices because they desire different outcomes. Differences in input choices reflect a parental preference for different outcomes for their boys and girls. This explanation has been a topic of active research in some developing countries where son preference is thought to be prevalent.

A third class of explanations derives from gender-based differences in the prices of inputs for boys and girls. For example, if it is more difficult to read to boys because they won't sit still, one unit of time input may be more costly for the parent to deliver to a boy than to a girl. As noted by Pollack and Wachter (1975), this opportunity price of parental time may reflect parental preferences (for example, parents enjoy giving inputs more to boys than to girls), as well as market opportunity costs, so it may not be possible to distinguish between this third class of explanation and the preference-based explanations discussed above.

We make a number of investigations to try to distinguish between the different explanations for gender differences in inputs. First, we address the issue of parental preference directly. Using information solicited post birth on whether the mother and her partner view the birth as being wanted, we show that neither mothers nor fathers exhibit a strong stated preference for boys or girls in the first few years after birth, but differences do emerge by ages 4 and 5 when fathers begin to favor boys. Second, we examine gender differences in parents' time inputs for fraternal twins, who parents may have an explicit preference to treat similarly. We document gender differences among twins that are comparable in magnitude to the effects documented in the full sample of children. This within-family evidence strengthens a conclusion that direct parental preference for boys or girls does not lie behind the differential treatment of boys and girls we document in the full sample. Third, we investigate whether the magnitude of the boy-girl difference in the provision of these time inputs varies with mothers' characteristics. We find associations with characteristics that can be viewed as proxies for the mothers' opportunity cost of time. Fourth, we track the impact of a significant change in opportunity cost of parent's time on the time inputs provided to boys and girls. To do this we exploit a policy in the Canadian province of Quebec that mandated universal, heavily subsidized childcare for children ages 0-5.[4] We find little effect on the time inputs provided to girls, but the subsidized care increases the time input for boys significantly. Taken together, this evidence argues against preference-based explanations in favor of the explanations focusing on the costs of delivering inputs to boys and to girls.

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[4] Baker et al. (2008) provide an overview of this program as well as investigate the impact of the policy on all children's outcomes.

Having documented the differences in time inputs across genders and investigated the sources of these differences, in the final step of the analysis we provide an indication of how much these differences matter. We do this by examining the impact of the differential treatment of boys and girls on the gender gaps in test scores at ages 4 and 5, as reported in table 1. In each country, we find the impact is non-trivial. Controlling for gender differences in parent's time inputs at younger ages attenuates the gender gaps in test scores by roughly 15 percent in the UK, and more than one-third in Canada. This evidence suggests that the differential inputs received by girls when young may contribute to the observed boy-girl school readiness gap.

2.0 Previous Literature

Our contributions in this paper build on a literature documenting the different treatment of boys and girls in developing and developed countries, as well as research into why parents may behave differently with boys and girls. In this section, we briefly discuss this previous research.

2.1 Previous evidence of differential treatment of boys and girls

One strand of the research on differences in the developmental inputs provided to boys and girls focuses on developing countries. In that work, the suspected source of any gender differences is an explicit parental preference for male offspring. Studies have documented a male advantage in nutrition (e.g., Das Gupta 1987), healthcare (e.g., Ganadtra and Hirve 1994) and vaccination rates (e.g., Borooah 2004). Jayachandran and Kuziemko (2009) and Barcellos et al. (2010) are two recent contributions to this literature finding gender differences in breastfeeding duration, childcare, vaccination rates, and vitamin supplementation.

There is less evidence of gender differences in the developmental inputs provided to children in developed countries (see Lundberg 2005a, and Raley and Bianchi 2006, for recent reviews of the literature). As noted in the introduction, there is evidence that males receive more total time input from their parents due to extra input from their fathers (Lundberg 2005b and Lundberg et al. 2007). By disaggregating total time into several categories, Yeung et al. (2001) find that boys receive relatively more of their fathers' time for play and companionship activities.[5] Aparna and Simon (2008) report no sex differences in prenatal care provided by parents in the U.S. who have had a prenatal ultrasound and presumably know the sex of their baby.

There is also evidence from the U.S. that male and female children grow up in different family structures. For example, Dahl and Moretti (2008) relate family structure to the sex of the first-born child. They report that among families with children aged 12 and younger, a first born female (versus male) raises the probability of an absent father by 3.1 percent, the probability that the mother has never married by 1.4 percent, the probability that parents are divorced by 1.3 percent and the probability that the mother has custody of the children in the event of a divorce by 2.9 percent. Related evidence is presented in Lundberg and Rose (2003).

We add to this body of research by focusing specifically on care provided to young children, motivated by the importance of the preschool years for later-life outcomes. We also provide a comparative analysis of three developed countries: the United States, Canada, and the United Kingdom. The comparison proves useful through checking whether results in one country hold in the others and by providing complementary analysis when data are not available in all countries in important dimensions.

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[5] Bryant and Zick (1996) provide evidence of the types of activities mothers and fathers participate in with their children is related to the child's gender.

2.2 Why would parents treat boys and girls differently?

Gender differences in the developmental inputs provided to children could arise for a number of reasons. Parents could simply directly prefer children of a specific gender. This preference is typically investigated by looking at fertility outcomes. While son preference is thought to be quite common in certain developing countries, there appears to be a general consensus that, on average, parents in developed countries do not exhibit a preference for children of particular sex by this measure. For example, the evidence offered in Angrist and Evans (1998) for the United States and McDougall et al. (1999) for Canada reveals that if anything parents in these counties have a preference for having a child of each sex. That said, son preference has been found in some immigrant/ethnic populations in these countries. Examining the sex ratio of births at different parities among mothers who have yet to give birth to a son, Abrevaya (2009) and Almond et al. (2013) report evidence of son preference within the East and South Asian communities of the U.S and Canada respectively.

Dahl and Moretti (2008) argue that son preference in the U.S is more widespread. They report that when the first born child is female, the total fertility of the family rises by 0.3 percent. This implies about 5500 of the roughly 4 million annual births in the U.S. are due to son preference. Dahl and Moretti (2008) also report direct evidence that men have a stated preference for male over female offspring based on Gallup polls. Related evidence for Denmark (Kohler et al. 2005) reveals that the self-reported happiness of fathers due to a first-born son is higher than for a first-born daughter. For mothers there is no relationship between the gender of the first born and the resulting happiness.

A second explanation for the differential treatment of boys and girls is differing biological needs and aptitudes (i.e., different production functions that map inputs into outcomes). With different production functions, the same inputs given to girls and to boys result in different outcomes. Research on cognitive differences between boys and girls is very active although not conclusive.[6] For example, differences at early ages in attention (favoring girls), cognitive perception (favoring boys) and fine motor skills (favoring girls) have been documented, although there is opposing evidence in each case. More uniformly documented is a female advantage in speaking and reading. At early ages (e.g., 16-30 months) evidence suggests girls lead boys by about a month of development and at preschool ages exhibit greater comprehension and use more complex verbal construction. Males hold an advantage in some visuospatial abilities. These differences could be biological. For example, one theory is that the higher exposure of males to androgens prenatally leads to right hemisphere dominance and so their advantage in cognitive tasks associated with this hemisphere. These tasks include higher level math and visuospatial skills.[7] An alternative explanation of production function differences is psychosocial. The values and stereotypes of society may matter—at early ages the different ways parents and caregivers dress, interact with and teach boys and girls. For example, Fryer and Levitt (2010) find that the gender gap in mathematics scores varies across countries and is correlated with gender-segregated schooling.

If boys are simply less or better skilled in certain dimensions we might expect parental time investments to adjust. One possibility is that parents reinforce existing skill differences (e.g., Becker and Tomes 1976, Aizner and Cunha 2012)—for example spending more time in

[6] Much of the following discussion follows Halpern (2011).

[7] Interestingly, Halpern (2011) concludes that documented physical differences in male and female brains—for example in grey and white matter and structures such as the hypothalamus—have so far been shown to have little leverage to account for sex differences in cognition.

speaking and reading activities with girls. Another possibility is that parents attempt to compensate for any skill deficits, as Price (2012) documents for the time parents spend reading with their children.

In addition to preference-based explanations and differences in how inputs are mapped into outputs, a third explanation for gender differences in parental inputs is the different costs of raising boys and girls. This includes both the money costs of material inputs and the costs of parental time. As noted earlier, the price of parental time may reflect parental preferences as well as market opportunity costs, so this account may interact with the preferences explanation.

Unfortunately, these different explanations have many common predictions and therefore can be difficult to distinguish (e.g., Lundberg 2005a). Furthermore, just as the distinct roles of prices and preferences blur in the third explanation, epigenetics tells us the distinct roles of biology and environment blur in the second. A further complication is that a child's gender can be associated with his or her parents' subsequent fertility decisions and living arrangements, which are additional important determinants of the inputs a child receives and his/her outcomes. To address this complication many researchers tailor their samples to try to minimize any bias. For example, Dahl and Moretti (2008) focus on the impact of the sex of the first born child, while Barellos et al. (2010) limit their sample to very young children to limit the amount of time for any other responses to the child's sex to occur. In our analysis we attempt to bring new data to the evaluation of these different explanations within a developed country context.

3.0 Data

Our main data sets are representative samples of children born in Canada, the U.S. and the U.K in the 2000s. The use of three countries allows us to exploit complementary questions and survey coverage across countries, as well as check that results for the U.S. hold up in other similar developed countries. For Canada the data come from the National Longitudinal Survey of Children and Youth (NLSCY). The NLSCY is a nationally representative survey of Canadian children conducted biennially between 1994/95 and 2008/09. We use waves 4-8, focusing on children of the birth years 1999 through 2004. Due to the biennial structure of the survey, these children are surveyed at ages 0/1, 2/3 and 4/5. For the U.S., our data are the Early Childhood Longitudinal Survey-Birth Cohort (ECLS-B). This survey is nationally representative of children born in 2001. We use data from the first three rounds, which survey the children when they were approximately 9 months old, 2 years old and 4 years old. For the U.K. our data are the Millennium Cohort Study (MCS) that samples children born in 2000/01. We use data from the first three “sweeps” which were collected when the children were roughly 9 months, 3 years and 5 years of age.

Each of these surveys reports cognitive test results, as documented in table 1, when the child is about to enter the formal school system. As discussed below, each survey also contains an array of variables that record the intensity of parents’ activities with their children, such as reading, singing and using new words and numbers.

A number of other data sets are also used in the analysis. The first is the American Time Use Survey (ATUS), a nationally representative survey of the American population used extensively in past research on parents’ commitments of time to their children. We use the 2003 through 2009 waves. The second is the National Survey of Family Growth (NSFG). This is a nationally representative survey of the American household population of men and women between the ages of 15 and 44. We use the 2002 and 2006-08 waves. The third is the Maternity Experiences Survey (MES). The target population of this Canadian survey is biological mothers who were 15 years of age or older at the time of their singleton live birth, who were living with their infant, and whose child was born in late 2005 or 2006.

We follow the practice of previous studies by focusing much of the analysis on samples of first-born children. It is among first-born children that we can view a child's sex as most likely to be randomly assigned. However, if family dynamics mean that a mother's first born is not the oldest child in the household and if there are significant birth-order effects in the treatment of children (e.g., Price 2008), then the way to define the sample is not straightforward. The details of how we identify the first born in each data set are reported in the appendix, and where possible we experiment with alternative definitions of the sample and report any sensitivity of the results.

4.0 Documenting Parental Time Commitments to their Children

We begin our analysis anchoring our findings in the previous evidence of parents' time with their children by examining minutes of overall time devoted to children. We break this analysis into smaller age groups than has been possible in the literature in order to see if the reported patterns are consistent across ages. We then disaggregate time use into several components and look into activities that most are plausibly linked to improved cognitive abilities.

We report the average amount of time parents spend with their first born boy or girl for these various inputs. We also report the estimate of a dummy variable for sex from the regression equation

(1) $y_i = X\beta + \varphi M_i + \varepsilon_i,$

where M_i is a dummy variable that equals 1 if child *i* is a male, y_i is the time input, and X are control variables. The vector X includes controls for child's age, mother's age, education and foreign birth, and regional and city location controls. The exact definitions of these variables for the various data sets are reported in the appendix. We do not control for the mother's marital status or the number of siblings because as discussed above these may be outcomes of the child being male.[8] In almost all cases, none of the controls has much effect on the inference.[9]

4.1 Overall time allocation by sex of child

Following the literature, we begin with the ATUS data, presented in table 2. With the additional waves of the ATUS now available we are able to focus on smaller age intervals than previous researchers, and in particular parents' time inputs when their children are very young. In the first panel are the results for the sample of oldest children at age 2 and younger. We examine measures of the amount of time mothers and fathers are involved in the primary (meaning a child-focused activity) and secondary (meaning children are present when another activity is undertaken) care of their children, as well as the time spent in specific activities—physical care, play and sports and reading, arts and crafts and talking. For each measure, we report the unconditional mean for male children and female children in the first two columns. The third column reports the coefficient φ and standard error for male children.

For mothers' time, none of the gender differences in table 2 is statistically significant. Also, most of the estimates are quite small and there is also no systematic pattern in their sign—some are negative, some are positive. For fathers' time, the estimated gender differences are a

[8] We have run regressions that include controls for marital status, father's characteristics, and siblings. Adding these controls has little impact on the estimates.
[9] This can be easily checked in our tables by comparing the difference in the reported male and female means to the 'conditional difference' that comes from our regression including controls.

bit bigger in magnitude, but again all are statistically insignificant. There is no strong evidence here of parental time flowing to children of a particular gender.

The results for the sample where the oldest child is age 3-5 are in the second panel. Again the estimates for mothers are all statistically insignificant, and all are quite small. However, for fathers we start to see a higher commitment of time to boys. There are now statistically significant differences in time committed to secondary care and to play that favor boys. For the former the difference is 24 minutes per day, while for the latter it is just over 10 minutes per day. Together with the results in the first panel this evidence for older children indicates that any extra time boys receive from their fathers emerges as the child ages. Fathers' extra commitment to boys does not appear to be an intrinsic characteristic of the relationship throughout the early years.

We do not have time diary data for Canada, but the NLSCY does have data on how frequently parents perform certain daily activities with children when they are ages 4 and 5. The person most knowledgeable (PMK) about the child is asked how often s/he eats, plays, talks through things, does chores or goes on outings with his/her child. The categories of response are: 1) every day, 2) 5-6 days per week, 3) 3-4 days per week, 4) 1-2 days per week, 5) 1-2 days per month and 6) rarely or never. We reverse the scale so a higher a number means more frequent activity to be consistent with other activity questions examined below. We also select only the cases where the PMK is the mother, because the PMK is also separately asked how often his/her spouse or partner does these activities with the child. This way we can separately examine mothers' and fathers' time input. The responses we examine cover all mothers, but the responses for fathers are for families where both mother and her partner are present.

The results for the daily activities in Canada are reported in Table 3. The estimates for mothers are mostly negative, indicating a higher frequency of the activities with girls, but all are statistically insignificant. In contrast the estimates for fathers are all positive, and the result for play is statistically significant. Consistent with the US evidence, by the time the child is at the upper end of our age interval of interest fathers spend more time playing with their sons.

We have also examined data from the United Kingdom Time Use Diary. Unfortunately, sample sizes for our target group in this survey are very small and so these data are not informative.[10]

4.2 Parents' Time Inputs Promoting Cognitive Abilities

One limitation of the results in tables 2 and 3, and in many previous studies, is the use of aggregate time categories. The link between aggregate time spent with the child and the child's developmental outcomes is not necessarily direct. However, the ECLS-B, NLSCY and MCS data each contain questions that ask parents about the frequency of activities with their children that have a more transparent relationship to cognitive development. These include teaching activities such as reading, singing, playing action games and teaching the use of letters and numbers. Price (2012) reports that variation in a similar question on the frequency of reading with a child in the U.S. National Longitudinal Survey of Youth has power accounting for variation in standardized reading tests.

For the US, the ECLS-B offers questions that focus on activities such as reading and singing songs. The frequency of the activity in the "typical week" is recorded on a 4 point scale:

[10] In samples for the oldest child the number of mothers averages about 200 in the two age groups, while the number of fathers is just over 60.

1) not at all, 2) once or twice, 3) 3-6 times and 4) every day. We examine the gender differences in each of the first three waves to observe how they potentially evolve as the child grows older.

The estimates of the gender differences in cognitive activities for the U.S. are reported in table 4. At 9 months (first panel), there is evidence that parents are more likely to read, and to a lesser extent sing songs, to their first-born girl than their first-born boy. The differences in the frequency of telling stories and going on errands also favor girls although are very small and statistically insignificant. By age 2 (second panel) this initial pattern is now well established, with statistically significant and larger effects favoring girls in all activities except running errands. There are also a number of additional variables available in the second wave. One is a variable asking whether the child had visited a library in the last month. This was more likely, by 6 percentage points, if the child is female. There are also questions about whether the child attends a “story time”, and the number of books and number of CDs/records s/he has. The estimates for these latter two variables are statistically significant again favoring girls. Finally, in the bottom panel of table 4 are the results at age 4. They provide further evidence of a female advantage in these inputs. New here is a variable capturing how long the child is read to, on the days this activity occurs. The female advantage is about 3 minutes on average.

The analysis of the cognitive-related variables available for Canada from the NLSCY is provided in table 5. The record of activities in these data is more extensive. The activities range from playing action games with very young children to teaching older children how to read new words. Also, the time reference is the past month and the answers are recorded on a five point scale: 1) rarely or never, 2) a few times a month, 3) once a week, 4) a few times a week and 5) daily.

At ages 1 and younger all the point estimates (except age first exposed to books) are negative, suggesting that males receive less of the indicated activity. There is a statistically significant difference for reading stories, echoing the result for the US at 9 months. There is also a statistically significant difference in the frequency of playing action games with the child and teaching him/her new words. At ages 3 and 4, the estimates are again negative, with the exception of time going on walks. Statistically significant differences are found for reading, singing songs, teaching letters and numbers and visiting the library, again confirming the inference from the ECLS-B data. There is also a statistically significant positive difference in the frequency boys are taken on walks.

The final cognitive activity results are from the MCS data for the UK and are presented in table 6. Here the coding of, and the response to, the questions differ somewhat by age. At age 3 the question is if “anyone at home” does the activity, except for the question about reading that solicits the activity of the main respondent and any partner separately. At age 5 the response is for the main respondent and the partner. For most activities the question canvases the usual level of activity in a week, ranging from “occasionally” to “7 times per week/constantly”. For each activity there is a separate question about the incidence of the activity, which we incorporate as a new, lowest, level of the intensity question so our variable captures both incidence and intensity as in the other surveys. Where needed, we again reverse the codes so a higher number implies greater frequency.

The estimates echo the results for the other two countries. At age 3, girls systematically receive more frequent interaction from their parents for all activities except perhaps counting. Some part of these effects is due to differences in the incidence of the activity. For example, girls are a statistically significant 6.0 percentage points more likely to have someone at home help them learn the alphabet. At age 5 the results are similar, and there is a positive estimate for going to the park lining up with the positive estimate for “walks” for Canada and for “errands” for the U.S.

To summarize, we have documented the gender differences in parental time inputs across three countries. We find statistically significant differences in fathers’ time inputs that favor males emerging at ages 3 to 5, but not yet evident at ages 0 to 2. Mothers’ time inputs display little correlation with the sex of the child. In all three countries, we find that teaching inputs conducive to building cognitive skills favor females. The implication of these differences, however, is not immediately clear. Certainly parental time is a central construct in the economic models of the production of children’s human capital (e.g., Becker and Tomes 1986). However, there is not yet an empirical consensus on what kinds of time are critical, although this question is being actively pursued in many disciplines (e.g., Farah et al. 2008, Paxson and Schady 2007).

5.0 Sources of Sex Differences in Parental Time Inputs

We have discussed three classes of potential explanations of the gender differences in parental time inputs that we documented in the previous section—preferences, production functions, and input prices. In this section, we bring some evidence to bear on these alternatives. Our first two exercises focus on the role of parental preferences. First, we look for direct evidence that parents have a specific preference for children of a specific sex. Second, we look at a subsample of fraternal opposite-sex twins in our UK sample, for whom parents might be expected to have an explicit preference for equal treatment. In the remaining two exercises we turn our attention to the opportunity cost of parental time. We investigate whether the magnitude of the boy-girl differential varies by mothers’ characteristics. Finally, we examine the impact of a policy experiment in Canada—introduction of subsidized daycare—that changed the opportunity cost of time spent with children.

5.1 Do Parents have a stated preference for children of a specific sex?

The traditional strategy for detecting an explicit parental preference for offspring of a specific sex is to examine fertility outcomes and responses of family structure to male or female births. These sorts of effects are found to be quite small and/or localized in Canada and the U.S., and so very large data sets are needed to identify them (e.g., Dahl and Moretti 2008).

We take a different tack here as we are interested in parents' preferences when their child is very young, and how their opinions might change as the child ages. Both the NSFG for the U.S. and the MES for Canada ask mothers about their feelings about the birth of their child. They ask whether the conception was timed properly (overdue, right time or mistimed) and whether it was wanted (indifferent, unwanted, not sure). The respondent is asked to answer the questions thinking back to the time just before she got pregnant. The answers are recorded, however, after the birth has taken place. Therefore, if the instructions are followed correctly there is no reason to expect a correlation of the answers with the sex of the offspring. To the extent there is a correlation, one way of interpreting the responses is as a direct solicitation of parental preferences for male or female children, conditional on their child's current age. In both surveys are reports of both the mothers' responses to the questions as well as the fathers' response as reported by the mother.

The analysis of these data is presented in table 7. In the first panel are the results from the NSFG for first born children aged 2 or younger. This age interval roughly matches the ages in our Canadian data and focuses on children born in the 2000s. Just over 50 percent of pregnancies are viewed as being at the right time while the proportion unwanted ranges from 6 to over 10 percent. The responses of mothers show a slight preference for girls, although it is only marginally statistically significant. For the mothers' report of the fathers' responses there is effectively no relationship with the gender of the child.

In the second panel are the results from the Canadian MES for the sample of children aged 5-15 months. The proportion of pregnancies at the right time is marginally lower than in the U.S. and the proportion unwanted is substantially so. Also echoing the results from the first panel for the U.S. there is very little evidence of a relationship between the responses and the child's gender.

These estimates do not suggest that parents have strong preferences for male or female first-born children. This is potentially at odds with evidence reported in Dahl and Moretti (2008) and Kohler et al. 2005 that fathers prefer boys. However, we are focusing on parents' preferences when the child is very young and the evidence in these other studies is not strictly comparable as they are based on broader age ranges. The NSFG allows us to further investigate this issue by focusing on parents' preferences when children are older. The results in the third panel of table 7 are for the sample of first born children aged 3-5. Note because we use the 2002 and 2006-2008 waves, our sample includes children born as early as 1996. Here there is a different story that is better aligned with previous evidence. Mothers' responses now exhibit a small preference for boys, although the estimates are small and mostly statistically insignificant. The big change is for the fathers' opinions, which swing significantly in favor of boys. That is, while the 'wantedness' of girls was indistinguishable from that of boys at younger ages, fathers' opinions of the wantedness seems to evolve through time in favor of boys.

The fact that a preference for boys is not observed for the U.S. in the age 2 and younger sample, or in the Canadian survey of very young children, suggests that fathers' stated preference for males (e.g., Dahl and Moretti 2008, Kohler et al. 2005) may not be intrinsic to the sex of the child at birth, but acquired as the child ages and they experience the differences of parenting children of different genders.

This interpretation is supported by analysis of ECLS-B data, which asks similar questions about the pregnancy in the first wave when the child is 9 months old. In these data, the estimate of the male dummy variable for a variable recording whether the mother viewed the pregnancy as wanted is 0.003 (0.015). Likewise when the variable is the mother's report of whether her partner viewed the pregnancy as wanted, the estimate is 0.003 (0.015).[11] There is no evidence in these data of a parental preference for males when the child is very young.

Interestingly the fathers' preference for boys emerges at the same ages that they start making a relatively larger time commitment to sons (as seen in tables 2 and 3). This all said, in the age intervals in which many of the cognitive time inputs are measured, there is little evidence by this standard of parental preference for children of a specific sex, and the evidence at older ages favors boys rather than girls.

5.2 Evidence from Twins

We next examine differences in parental time investments across twins. For the examination of gender differences we are necessarily limited to fraternal twins. Because fraternal twins are only as genetically similar as any other sibling pair, the key twin feature we wish to

[11] The MCS survey does not have a corresponding set of questions. There is a question in the first (9 months) sweep asking the mother if the pregnancy was planned. The estimated parameter on the male dummy for this variable is -0.007 (0.007).

exploit is their common developmental environment, and in particular their parents' preference to treat them similarly. Whether parents treat fraternal twins similarly, relative to the treatment of identical twins, is a topic of ongoing debate. The assumption that there is a similarity of treatment approaching that of identical twins is a building block of the "equal environment assumption", a foundation of twin studies that compare monozygotic and dizygotic pairs (e.g, Medland, and Hatemi 2009).[12] For our purposes here we want to exploit the fact that parents wish to treat opposite sex dizygotic twins with greater similarity than parents generally treat sons and daughters.

The ECLS-B survey over-sampled twins and so is potentially very useful for this purpose. However, perhaps anticipating that twins would be treated equally, the questions on time inputs were not asked separately for each twin. However, it is possible to examine twin differences in time inputs for fraternal twins for the UK in the MCS, as in this survey the preference questions were asked separately for these brother and sisters. The MCS does not over-sample twins, however, so we are limited to 84 twin pairs in the first wave; 62 pairs in the second wave.

Estimates of inter-twin differences in the parent time inputs recorded in the MCS at age 3 are reported in table 8. Note that our control variables difference out in these regressions since they are common to each twin. For most of the activities the levels are lower for the twins than for their full sample counterparts (table 6). However, the boy/girl differences are of the same sign as in the full sample, and statistically significant for singing and painting. Also, the difference in the incidence of teaching the alphabet is a statistically insignificant 5 percentage

[12] These studies typically compare same sex fraternal twins to similarly sex identical twins. There is also a growing literature on violations of the equal environment assumption (see Conley and Rauscher 2011 for a discussion). Many of the documented violations are in environments twins experience as older children and as adults.

points in favor of girls, a point estimate that matches the full sample estimate of 6 percentage points well.

These results suggest that even across opposite-sex fraternal twins, boys receive less of time inputs such as reading and the teaching of letters and numbers. This again suggests that parental preference, here manifested in a preference for equal treatment, is not the deciding factor driving these parental time inputs.

5.3 Evidence of Variation in the Boy-Girl Difference by Mothers’ Characteristics

In this section we investigate variation in the boy-girl difference in the provision of parental time inputs by mothers’ characteristics. Several of the observable characteristics may be interpreted as informative about mothers’ opportunity cost of time. To conserve space we focus on the time spent reading. This is an input in which there is a boy-girl differential in each country. It is also a differential that emerges when the child is very young. We also restrict our attention to estimates for samples of children aged more than 1 year. Maternity leave entitlements vary significantly across countries for our cohorts, from 0-3 months in the US to 12 months in Canada. This is an obvious confounding factor that complicates the comparison of the results across countries from samples of children aged less than one year. While not definitive, this exercise can shed light on whether the lower inputs provided to boys is related to other markers of preferences or of mothers’ opportunity cost of time.

The results are reported in table 9. The dependent variable is indicated for each country. In this table, each row shows a different sample with the same dependent variable. In the first panel is the split by education: mothers with a high school diploma or less and all other mothers. For the UK we define high school graduation as completion of the General Certificate of

Secondary Education, or O-levels for older cohorts of mothers. The estimates for Canada and the U.S. provide consistent evidence of a larger boy-girl differential among children of more educated mothers. In the UK the inference is just the opposite, which may reflect North American versus UK differences in the completion of higher rates of education among these cohorts of mothers.

In the second panel we split the sample by mother's employment. Here a comparison of the results across countries is complicated by differences in maternal employment. Maternal employment at this time is highest in Canada and lowest in the United Kingdom, the difference being roughly 10 percentage points (OECD 2012). The results for Canada and the UK indicate a bigger boy-girl difference for working mothers, while the results for the US, which are for younger children, offer modest support for the opposite conclusion. This may be related to an age profile in the effect, as more mothers return to employment as the child ages. The results for Canadian children aged 0-1 (not reported) are consistent with the results for the US: a higher boy-girl differential for non-working mothers.

The third panel contains the results by mothers' marital status. Rates of out of wedlock birth are fairly similar between the US and the UK, but up to 33 percent lower in Canada (Ventura 2009). Also complicating the comparison across countries is that the marital status indicator for the Canadian data captures both legal and cohabiting relationships. For these reasons we focus on the US and UK results, which tell a consistent story wherein the boy-girl differential is larger for single mothers.

In the fourth panel we split the sample by the mothers' age at birth. In Canada and the UK it is the children of older mothers that exhibit the higher boy/girl difference, while in the US the difference does not differ strongly by mothers' age.

Finally in the last panel is the split by the mothers' place of birth. In all three countries the estimate of the boy girl difference is larger for foreign born mothers, although it is not always statistically significant.

These results indicate some significant variation in the gender difference by mothers' characteristics. In some instances (education, employment, marital status) the results suggest that the gender difference is higher for mothers who arguably have a higher opportunity cost of time, while others (place of birth) are perhaps more consistent with a preference story. An alternative hypothesis would be that there is some unobserved characteristic of boys that engenders relatively lower levels of reading from mothers and is correlated with the all the different characteristics in table 9. This seems a harder story to tell as the maternal characteristics associated with higher boy-girl differentials do not blend easily into a single coherent profile.

5.4 Evidence from the Quebec Family Plan

Our final investigation is how the provision of universal, heavily subsidized childcare affects the time inputs provided to boys and girls. Subsidized childcare changes the price of parental versus non-parental provision of some inputs, and we use it here to study how parents of boys and girls reacted to the introduction of subsidized care.

Starting in 1997, the Canadian province of Quebec introduced a new policy that provided childcare to all children aged 0-4 at a price of $5 per day. The new policy came into effect for children aged 4 in 1997, aged 3 in 1998, aged 2 in 1999 and for those aged 0-1 in 2000. Baker et al. (2008) provide a full description of the program as well as investigate the impact of the policy on children's social, motor and non-cognitive development.

Economic theory predicts that childcare subsidies increase the net wage, or alternatively decrease the reservation wage, which increases the probability of maternal employment. Therefore we should expect the amount of maternal care children experience to decrease, a result confirmed for the Quebec program in Baker et al. (2008).[13] Our interest here is in the content of the maternal, or more generally parental, care that remains. There is not a lot of research on this topic. Baker et al. (2008) report that the average quality of parenting in Quebec declined with the introduction of the subsidized child care program. Herbst and Tekin (2012) report that childcare subsidies in the U.S. are associated with poorer parent child-interactions. These outcomes might result from any stress that arises from managing a two-worker household.

Our focus is the impact on the time inputs that parents supply to their children. Non-parental care arguably provides a substitute for the parental time inputs under study here. The curriculum provided while the child is in care delivers a certain level of inputs to the child, and we assume this curriculum is gender neutral. If this assumption is true, our evidence on the girl-bias of cognitive-related inputs given by parents suggests that the childcare curriculum delivers a relatively larger amount to boys, since they are moving from a position of less provision of inputs to one of equal provision. If the marginal value of reading time, for example, is declining in the amount received, we might then expect to see the care given in the childcare being reflected in an adjustment of parental time inputs, presumably downwards, once the child is in care, and this may differ across girls and boys.An alternative view is that non-parental care is a poor substitute for the time inputs we examine (e.g., Guryan et al. 2008). In this case, the amount of reading time etc. that children receive in parental care does not have a direct impact on parents' choices. However, the willingness of parents to spend time on cognitive-related

[13] Empirically, in some cases the availability of subsidized or free childcare only leads to a crowd out of other types of non parental care. See for example Fitzpatrick (2010).

activities may reflect the limitations that work puts on the parents' time, so parents may be more willing to persevere with costly activities once freed from caring for the child all day.

To investigate the impact of the Quebec universal child care program we use waves 1-2 and 4-5 of the NLSCY. These surveys were conducted in 1994/95, 1996/97,[14] 2000/01 and 2002/03. We omit wave 3 because it was conducted in years in which some of the children in our target age group were eligible for subsidized child care and some were not.

Our empirical framework is a difference-in-differences approach following Baker et al. (2008), using children living in the other province of Canada as a control group. For each dependent variable we estimate the equation

$$(2) \qquad Y_{ipt} = POST_{pt}\beta + POST_{pt} \times QUE_{pt}\eta + X_{ipt}\varphi + \varepsilon_{ipt}$$

where *i* indexes individuals, *p* indexes provinces and *t* indexes year. *POST* is 0/1for observations in the period the Quebec universal childcare program is available, while *QUE* is the dummy variable for observations from Quebec. Because *X* includes province and wave effects (in addition to our regular explanatory variables), η is identified by the change of the conditional mean of the dependent variable in Quebec between the "pre" and "post" periods relative to the corresponding change in the other provinces. We estimate this equation separately for first born boys and girls, and also for a pooled sample with a dummy variable and interaction for boys.[15] Our estimates will pick up any gender differences due to switching from non-work to work as well as between previous care settings and the new subsidized program. We report the impact of

[14] The survey dates in 1997 precede the introduction of the Quebec program in September 2007.
[15] In the earlier waves of the NLSCY information on the number of babies the mother has given birth to, is not available consistently for all children. We construct a measure of firstborn in this same spirit by comparing the difference between the mother's current age and her age at her first birth to the child's current age. The results using this method of identifying the first born are very similar to those reported in table 10.

the introduction of the program, so these are intention-to-treat effects; the resulting gender differences could be scaled by the proportion treated to obtain an estimate of treatment on the treated.

The NLSCY provides a limited number of time inputs we can investigate in these earlier waves. One variable in each wave is the amount of time the parents spend reading to (or 'with', depending on the age) the child. We also have information for the age (months) at which the child was given his/her first book. We also examine a 0/1 variable capturing whether the child's mother works as a measure of treatment.[16] Finally, we focus on children aged 0-1.[17] At these ages it is less likely that exposure to the curriculum in child care would affect children's preference or aversion for reading. Also, as shown below, the treatment of boys and girls in this age group is very similar.

The results are in table 10. The first row contains the estimates for an indicator that the mother works. The estimates of *POST* from the male and female samples indicate that there was a positive secular trend in mothers' work over the period, which is consistent with the pattern over this time period for many developed countries. The impact of the policy is the significantly larger increase in work in Quebec by 7.3 to 9.0 percentage points across the three samples. This is not far off the estimate in Baker et al. (2008), which used a sample of children in two parent families and found an impact of 7.7 percentage points. The proportion of mothers working in Quebec before the policy did not differ by the child's sex, so the similarity of the estimates for boys and girls indicates they received similar treatment from the policy. This is confirmed in the estimates from the pooled sample—the estimate of the interaction of *POST* with a dummy variable for males is small and statistically insignificant.

[16] We prefer this employment measure to variables recording whether the child is in care because of the uncertainty surrounding responses to some of the child care questions in the NLSCY as documented in Baker et al. (2008).
[17] This corresponds to the first survey of a given cohort of children.

In the next two rows are the estimates for the parental inputs. There is no indication that the policy had any effect on the age either boys or girls received their first book. The policy did, however, have an effect on how often parents read to their male children. First note there is a trend increase in the amount parents read with their child in the rest of the country that is not correlated with sex. However, this may be in part a creature of a change in the response categories for this question across waves.[18] Second, the increase in reading for girls in Quebec is very similar to that experienced by their counterparts in the rest of the country. In contrast, the increase in reading with boys in Quebec is significantly larger. This inference about boys is confirmed in the results for the pooled sample, although here we also see a significantly positive increase in reading with girls in Quebec when the parameters on the other conditioning variables are restricted to be the same for boys and girls.[19]

Note that these results appear to be in conflict with the results in table 9, which showed higher levels of the boy-girl difference in reading for children of working mothers. However, for Canada in the sample of children *aged 0-1 years* it is the children of non-working mothers that exhibit the larger difference. In the sample of children of working mothers for this age group the estimate of the difference for children this age is -0.099 (0.062), while for children of mothers who are not employed the estimate is -0.129 (0.044).

[18] In the pre-policy period the intensity of parents' reading activity was coded on an 8 point scale, while in the post policy waves it was recorded on the 5 point scale used in later waves. While the 8 point scale maps directly into the 5 point scale, we do not know the effect of giving parents finer delineations of both very low and very high level of time inputs on the mean response. For example, in the 5 point scale the lowest category is "rarely or never" that parents' might purposely avoid so not to leave the interviewer with the impression that they never read to their children. Another possible factor is the increase in the national maternity leave entitlement from 6 months to one year in 2000. This change in the entitlement might actually negatively impact the boy/girl reading time differential, because in this age group the differential tends be smaller among children of working mothers (see below).

[19] We have also investigated the impact of the childcare program on older children. Here the equal treatment of girls and boys does not hold, undermining our comparison strategy. The results indicate that the increase in work for mothers of boys is several times as large as the increase for mothers of girls. In fact the increase for girls is not much more than the increase for mothers of girls in the rest of the country. These results are available on request..

These results indicate that parents do not view the time inputs provided by caregivers as good substitutes for their own, since parents do not appear to decrease the inputs they provide themselves to account for inputs received by the children while in childcare. For example, the estimates indicate that the rate at which Quebec parents read to girls kept pace with changes in the rest of the country.

The fact that we find a relative increase in reading to boys may be most consistent with the third of our classes of explanation for gender differences; that the opportunity cost of providing inputs differs across boys and girls. It may be less rewarding to provide inputs (like reading time) to boys because, for example, boys wiggle and squirm. With the child in care, the parents have only a limited amount of time with the child each day, making the parents more willing to persevere when delivering inputs to the child. Alternatively, a day in care may consume the majority of any “excess energy” that boys exhibit, leading to a more rewarding reading experience.

6.0 Time Inputs and Test Scores

In this last section, we attempt to calibrate the consequences of our findings by investigating whether the difference in parental time inputs across boys and girls has any impact on the measures of cognitive development presented in table 1. In other words, we attempt to see if these differences in cognitive inputs matter for test scores which are predictive of later-life success. Price (2012) reports that differences in parents’ reading time with children across birth order has power accounting for corresponding birth order effects in children’s standardized reading test scores (see also Black et al. 2005 and 2011).

It is important to acknowledge, however, that these scores are likely not a comprehensive summary of the development parents' time promotes, and that measuring the cognitive development of young children is known to be challenging.[20] We address issues of causation immediately below, then provide a description of the data.

Our strategy is to first regress each cognitive score on our standard control variables as per equation (1). We then add the measures of the parental time inputs (ACT) the child received from his or her parents at younger ages. Each activity is entered as dummy variables representing the different levels of frequency. The equation estimated is

$$(3)\ y_i = X\beta + \varphi M_i + ACT_i\kappa + \varepsilon_i.$$

We then compare the estimates of the parameters on the dummy variable for male children in the two specifications.

To interpret the results of these regressions causally relies on an assumption that the parents' reports of the activities are in fact capturing inputs and not alternative measures of some latent outcome that our cognitive scores are also measuring. This assumption is more compelling when the inputs of parental activities are measured at ages prior to the cognitive tests. Also, note that the working assumption here is that the time inputs are equally productive for boys and girls.[21]

We examine each of the cognitive measures reported in table 1. In the ECLS-B data these are math and reading scores that are recorded in wave 3 when the children are roughly four years

[20] See, for example, Bradley-Johnson (2001) and Saye (2003).

[21] The alternative assumption is that the time inputs are differentially productive for boys and girls. An obstacle to testing this hypothesis is unobserved factors in both the boys and girls test score "production function" that lead to biased estimates of the parameters on the time inputs. See Todd and Wolpin (2003) for a discussion of the issues.

of age, and are formulated specially for this survey. Each instrument draws on well-known cognitive tests such as the Peabody Picture Vocabulary Test (PPVT) and the Test of Early Mathematics Ability-3.[22] In the NLSCY we have PPVT scores and scores on the Know Your Numbers (KYN) test, both administered at ages 4 and 5. In the MCS are Picture Similarity, Pattern Construction and Naming Vocabulary test scores.[23] These are subscales of the British Ability Scales, Second Edition. As documented in table 1 there are systematic sex differences in almost all of these developmental tests.

The analysis of the ECLS-B data is in table 11, in the top panel. Because the sample of four and five year olds with valid observations on parents' time inputs from previous waves does not exactly match the full sample of four and five year olds with valid test scores in round 3, the estimates of sex gaps in the test scores conditional on our standard control variables in the first column do not exactly match the estimates in table 1.[24] That said, the differences are quite small. In the second column of each row is the estimated sex difference in the indicated score when in addition we control for the parental inputs reported in tables 4 and 5. In each case the estimated sex difference is smaller once the additional controls for inputs are added. The most substantial reductions are for the inputs measured at age 2. The addition of the input variables reduces the sex difference in reading scores by 23 percent and the sex difference in the math score by 25 percent.

Corresponding analysis of the NLSCY data is in the middle panel of table 11. Recall the NLSCY canvases a more extensive set of inputs, a number of which focus on specific learning activities (e.g., teaching new words or numbers). Also, the NLSCY has a more complex

[22] A listing and discussion of the tests the instrument are based on can be found in *The ECLS-B Direct Assessment Choosing the Appropriate Score for Analysis* at nces.ed.gov/ecls/pdf/birth/ChoosingScores.pdf
[23] We use the "ability" rather than "raw" versions of these test scores.
[24] This is also true for the NLSCY and MCS.

longitudinal structure, with multiple cohorts whose aging across waves of the survey does not perfectly match the age cutoffs for the questions about specific inputs.[25] As in the U.S. data controlling for the gender differences in inputs at very young ages has a rather modest impact on the gender gap in scores. The inputs measured at older ages have a larger impact, reducing the gap in PPVT by 36 percent and in Know Your Numbers scores by roughly 50 percent.

Finally the results for the UK data are in the bottom panel of the table. Here we relate cognitive scores at age 5 to parents' time inputs at age 3. Adding the inputs reduces the gender gap in both the Picture Similarity score and the Pattern Construction score by 15 percent. The reduction in the Naming Vocabulary score is much larger, but for this score the gender gaps are statistically insignificant.

7.0 Conclusions

We re-examine and extend the literature on how parental time inputs differ across boys and girls. Our focus is children at preschool ages. We first offer a refinement of evidence in previous studies that boys receive more parental time than girls due to extra time input from their fathers. We show that this higher time input from fathers only emerges with age, and is not present when children are very young. We next examine specific parental time inputs that are related to teaching, rather than the general categories of time that have been studied in the past. This change in focus leads to a significant change in inference. It is girls, not boys, who systematically, in three leading developed countries, receive more of these time inputs from their parents. The inputs examined include reading, storytelling, and teaching letters and numbers.

[25] For example, in their second interview a cohort of children will be ages 2 and 3, and so half we will have responses for the age 0-2 inputs and half will have responses for the age 3-5 inputs.

We attempt to discover what lies behind this difference in parental time between boys and girls. We offer evidence that the observed differences are not due to a direct preference of parents for children of a specific sex at these ages, and the differences remain present despite any desire of parents to treat fraternal twins similarly. The gender differences, however, are correlated with a number of mothers' characteristics, some of which can be interpreted as proxies for the opportunity cost of time. Given that time spent reading with children (primarily boys) increases after the introduction of a new child care subsidy, the parental time inputs we study may not be easily substituted by non-parental care. Instead, this finding is consistent with a story in which boys are less rewarding to teach, and parents are more willing to persevere with boys once they are not responsible for their care throughout the day. The weight of the evidence from these investigations suggests that the relatively lower rates of time inputs for boys is more likely related to the time pressures on parents and their willingness to spend time in cognitive promoting activities, rather than related to something intrinsic to male children.

Finally we show that these boy-girls differences in parental inputs make some contribution to the corresponding differences in their preschool cognitive scores. While the latter are relatively modest, the tests are recorded at young ages, and so the impact may cumulate at older ages if learning deficits and advantages are cumulative. Furthermore, we are limited in our data to connect the boy-girl differential in time inputs to early childhood cognitive scores, while they may have impacts on a wider range of outcomes. For example, parental teaching may embed behavior patterns that children need to excel at school. Therefore, the boy-girl differences we document may contribute to the male deficit in non-cognitive skills that has been linked to problems at higher grades (Bertrand and Pan 2013, Cornwell et al. 2013, Jacob 2002). They may also precipitate patterns in children's own use of time at older ages.

Data Appendix

U.S. Data

ATUS: Each household has one respondent who answers the time-use questions, so we have either a mother or a father from each household, but never both in the sample. We draw a sample of oldest children aged zero to ??. We include own children in and outside the household. For the regressions, we include controls for age (single year), mother's / father's age (five year groups), mother's / father's education (four categories), mother's / father's foreign birth, region, race (black and Hispanic), survey year, survey month, and diary day.

ECLS-B: For the regressions we include controls for age (single month), birth state, mother's age (single year), education, foreign birth and indicators for whether the mother is black or Hispanic.

NSFG: The information on children is built up from the pregnancy histories of the surveyed women. The analysis makes use of recoded variables provided in the NSFG but omits observations with imputed values of these variables. The control variables for the NSFG regressions include dummies for mother's age at conception, child's age, child's month and year of birth, mothers' education, ethnicity (black, Hispanic), religion (catholic, protestant, none), foreign birth and rural location.

Canadian Data

MES: The survey excludes mothers living on Indian Reserves or collective dwellings. There is no imputation of variables in the MES. The control variables in the MES regression are child's age (single year), mother's age (single year), and dummy variables for mother's education (4 categories), aboriginals, province and rural residence.

NLSCY: In each biennial survey, new cohorts of children aged 0 and 1 enter the survey. These cohorts are interviewed again at ages 2/3 and 4/5. Not all children are captured in later surveys due to attrition, or for some cohorts by design. Other cohorts receive top up samples at ages 2/3 and 4/5. The control variables for the regressions are child's age (single year), mother's age (five year age groups), mother's education, mother's foreign birth, dummy variables for province, urban size (5 categories) and year of birth.

United Kingdom Data

MCS: The control variables for the regressions are education, child's age at time of survey (single month), mother's age at birth (single year), country of birth and ethnicity (Chinese, other Asian, black). At Age 3 the reading question is coded 1) every day, 2) several times a week, 3) once or twice a week, 4) once or twice a month, 5) less often and 6) not at all. The questions about library trips is coded 1) on special occasions, 2) once a month, 3) once a fortnight and 4) once a week. The remaining questions are coded 1) occasionally or less than once a week, 2) 1-2 days per week 3) 3 times per week, 4) 4 times per week, 5) 5 times per week, 6) 6 times per week and 7) 7 times per week/constantly. At age 5 all activities are coded are coded 1) every day, 2) several times a week, 3) once or twice a week, 4) once or twice a month, 5) less often and 6) not at all except library trips that are coded 1) every day or almost every day, 2) several times a week, 3) once or twice a week, 4) at least once a month, 5) every few months, 6) at least once a year, 7) less often or never.

Identifying the First Born

In each data set we identify the first born as directly as possible given the questions available in the survey. Where alternative strategies are available we have investigated them. In these cases the sex differences reported in the paper are not sensitive to the method we use to identify the first born. This is due to the fact that they are also present for higher parity children.

ATUS: The first born is identified based on the family structure reported. We label the oldest 'own' child as the first born

ECLS-B: The first born is identified according to the number of previous live births the mother has had taken from the birth certificate.

NSFG: The first born is identified as the child from the mother's first pregnancy that resulted in a singleton live birth.

MES: The first born is identified by a question answered by the mother about any previous live births.

NLSCY: The first born is identified based on the family structure (i.e., absence of older siblings in the household) recorded in the child's first survey (at ages 0-1).

MCS: The first born is identified by information on the structure of the family at the first survey (any siblings present) and a question answered by the mother on any previous live births.

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Table 1: Sex differences in Selective Cognitive Tests at ages 4-5

	Males	Females	Conditional Difference
US			
Reading Score	25.66	27.60	-1.851***
			(0.454)
Math Score	29.54	30.88	-1.227***
			(0.390)
Canada			
PPVT	101.32	103.52	-2.773***
			(0.832)
Number Knowledge Score	1.227	1.268	-0.066**
			(0.028)
UK			
Picture Similarity Score	82.05	83.56	-1.610***
			(0.331)
Naming Vocabulary Ability Score	110.46	111.02	-0.376
			(0.411)
Pattern Construction Ability Score	87.44	89.87	-2.381***
			(0.533)

Notes: Authors' calculations from the US ECLS-B, the Canadian NLSCY and UK MCS. Reported in the first two columns are the unconditional means of each test score for the samples of male and female children. The third column reports the estimated coefficient on the male binary indicator in a regression including the control variables described in the appendix. Robust standard errors in parentheses. One star indicates significance at the 10 percent level; two stars for 5 percent; three stars for 1 percent.

Table 2: **Sex Differences in Parents' Time Inputs in the United States—First Born**

	Males	Females	Conditional Difference
Age 2 and Younger			
Mothers			
Primary care time	165.4	164.5	2.2
			(5.9)
Secondary care	407.1	400.5	4.3
			(11.2)
Physical care	86.5	89.0	-1.5
			(4.2)
Play and Sports	57.9	56.5	1.7
			(3.8)
Reading, Arts and Crafts, Talking	5.0	5.9	-0.7
			(0.7)
Fathers			
Primary care time	94.7	88.4	6.3
			(7.1)
Secondary care	263.0	264.9	2.6
			(11.9)
Physical care	41.8	37.9	2.7
			(5.0)
Play and Sports	43.1	37.5	6.7
			(4.9)
Reading, Arts and Crafts, Talking	2.7	4.1	-1.2
			(0.7)
Age 3-5			
Mothers			
Primary care time	125.5	126.4	-0.6
			(4.4)
Secondary care	406.3	402.6	4.8
			(9.5)
Physical care	52.5	56.6	-4.1
			(2.3)
Play and Sports	39.0	37.9	1.5
			(2.7)
Reading, Arts and Crafts, Talking	8.9	8.7	0.2
			(0.7)
Fathers			
Primary care time	84.8	77.9	7.2
			(5.1)
Secondary care	265.8	235.3	24.1**
			(10.3)
Physical care	25.8	26.4	-0.9
			(2.3)
Play and Sports	42.8	32.4	10.6***
			(3.8)
Reading, Arts and Crafts, Talking	5.5	5.5	0.0
			(0.7)

Notes: Authors' calculations from ATUS data. Reported in the first two columns are the unconditional means of each dependent variable for the samples of male and female children. The third column reports the estimated coefficient on the male binary indicator in a regression including the control variables described in the appendix. Robust standard errors in parentheses. One star indicates significance at the 10 percent level; two stars for 5 percent; three stars for 1 percent.

Table 3: Sex Differences in Parents' Time Inputs in Canada—First Born

	Males	Females	Conditional Difference
Mothers			
Frequency of eating with child	5.773	5.818	-0.045 (0.035)
Frequency of playing with child	4.884	4.847	0.030 (0.065)
Frequency of talking with child	5.120	5.927	-0.015 (0.020)
Frequency of doing chores with child	4.824	4.815	-0.014 (0.066)
Frequency of outings with child	4.065	4.075	-0.017 (0.058)
Fathers			
Frequency of eating with child	5.337	5.348	-0.006 (0.060)
Frequency of playing with child	4.428	4.213	0.243*** (0.077)
Frequency of talking with child	5.608	5.549	0.057 (0.050)
Frequency of doing chores with child	3.723	3.635	0.103 (0.085)
Frequency of outings with child	3.479	3.462	0.042 (0.060)

Notes: Authors' calculations from NLSCY data. Sample includes children aged 4 and 5. Reported in the first two columns are the unconditional means of each dependent variable for the samples of male and female children. The third column reports the estimated coefficient on the male binary indicator in a regression including the control variables described in the appendix. Robust standard errors in parentheses. One star indicates significance at the 10 percent level; two stars for 5 percent; three stars for 1 percent.

Table 4: Parental Time Inputs Promoting Cognition, United States—First Born

	Males	Females	Conditional Difference
9 Months			
Read Stories	2.782	2.880	-0.083**
			(0.041)
Tell Stories	2.578	2.597	-0.010
			(0.047)
Sing Songs	3.635	3.687	-0.046
			(0.028)
Errands	3.511	3.523	-0.012
			(0.023)
2 Years			
Read Stories	3.152	3.283	-0.118***
			(0.034)
Tell Stories	2.659	2.749	-0.098**
			(0.045)
Sing Songs	3.520	3.638	-0.098***
			(0.031)
Errands	3.531	3.490	0.038
			(0.030)
Visit Library Past Month	0.234	0.295	-0.060***
			0.020)
Child Attends Story Hour	0.115	0.126	-0.011
			(0.014)
Number Books	39.91	44.47	-4.145**
			(1.573)
Number records/CDs	8.317	9.250	-1.052***
			(0.573)
4 years			
Read Stories	3.093	3.221	-0.119***
			0.036)
Tell Stories	2.714	2.791	-0.059
			(0.043)
Sing Songs	3.245	3.459	-0.196***
			(0.038)
Minutes Reading	24.52	27.80	-2.942***
			(0.930)
Visit Library Past Month	0.365	0.405	-0.041*
			(0.022)
Child Attends Story Hour	0.298	0.331	-0.035
			(0.035)
Number Books	65.86	70.23	-3.274
			(3.197)

Notes: Authors' calculations from ECLS-B data. Reported in the first two columns are the unconditional means of each dependent variable for the samples of male and female children. The third column reports the estimated coefficient on the male binary indicator in a regression including the control variables described in the appendix. Robust standard errors in parentheses. One star indicates significance at the 10 percent level; two stars for 5 percent; three stars for 1 percent.

Table 5: **Parental Time Inputs Promoting Cognition, Canada—First Born**

	Males	Females	Conditional Difference
Age 0-1			
Play action games	4.830	4.864	-0.035* (0.020)
Take on errands	3.981	4.004	-0.023 (0.031)
Go on Walks	4.381	4.422	-0.047 (0.035)
Read stories	4.486	4.613	-0.114*** (0.037)
Tell Stories	4.163	4.201	-0.025 (0.053)
Sing Songs	4.699	4.732	-0.031 (0.029)
Teach new words	4.619	4.702	-0.071* (0.041)
Age exposed to books	3.899	3.817	0.079 (0.116)
How often goes to library	1.382	1.404	-0.022 (0.041)
Age 3-4			
Go on Walks	4.408	4.374	0.023 (0.033)
Read books	4.380	4.523	-0.162*** (0.043)
Tell Stories	4.487	4.595	-0126*** (0.039)
Sing Songs	4.313	4.524	-0.221*** (0.043)
Teach to read new words	3.382	3.368	-0.024 (0.074)
Teach letters and numbers	3.894	4.020	-0.137*** (0.053)
Encourage use of numbers	4.501	4.560	-0.070* (0.040)
How often goes to library	1.933	2.025	-0.120*** (0.042)

Notes: Authors' calculations from NLSCY data. Reported in the first two columns are the unconditional means of each dependent variable for the samples of male and female children. The third column reports the estimated coefficient on the male binary indicator in a regression including the control variables described in the appendix. Robust standard errors in parentheses.

One star indicates significance at the 10 percent level; two stars for 5 percent; three stars for 1 percent.

Table 6: **Parents' Time Inputs Promoting Cognition, UK—First Born**

	Males	Females	Conditional Difference
Age 3			
Reading (mother)	5.227	5.297	-0.090***
			(0.020)
Teach Alphabet	3.820	4.137	-0.311**
			(0.045)
Teach Counting	5.919	5.960	-0.062
			(0.043)
Teach Songs	5.957	6.386	-0.438***
			(0.041)
Paint (PMK)	5.393	6.359	-0.920***
			(0.040)
How often goes to library	1.957	2.012	-0.053***
			(0.024)
Age 5			
Reading	5.395	5.438	-0.044*
			(0.025)
Tell Stories	3.628	3.743	-0.121***
			(0.044)
Musical Activities	4.810	5.062	-0.244***
			(0.033)
Drawing	3.885	4.149	-0.262***
			(0.034)
Play Games	4.782	4.709	0.084***
			(0.031)
Go to Park	3.817	3.771	0.054*
			(0.029)
How often goes to library	2.629	2.694	-0.066
			(0.042)

Notes: Authors' calculations from MCS data. Reported in the first two columns are the unconditional means of each dependent variable for the samples of male and female children. The third column reports the estimated coefficient on the male binary indicator in a regression including the control variables described in the appendix. Robust standard errors in parentheses. One star indicates significance at the 10 percent level; two stars for 5 percent; three stars for 1 percent.

Table 7: **Parents' Views of the Wantedness and Timing of the Pregnancy-First Born**

	Males	Females	Adjusted Difference
US Age 2 and Younger			
Mother: didn't want pregnancy	0.096	0.060	0.033* (0.020)
Mother: pregnancy at right time	0.503	0.537	-0.036 (0.032)
Partner: didn't want pregnancy	0.106	0.106	-0.001 (0.021)
Partner: pregnancy at right time	0.529	0.527	0.007 (0.035)
Canada Age 5-15 Months			
Mother: didn't want pregnancy	0.039	0.032	-0.004 (0.007)
Mother: pregnancy at right time	0.473	0.464	0.003 (0.021)
Partner: didn't want pregnancy	0.039	0.041	-0.002 (0.007)
Partner: pregnancy at right time	N.A.	N.A.	N.A.
US Age 3-5			
Mother: didn't want pregnancy	0.081	0.118	-0.029 (0.020)
Mother: pregnancy at right time	0.517	0.482	0.018 (0.032)
Partner: didn't want pregnancy	0.081	0.142	-0.063*** (0.022)
Partner: pregnancy at right time	0.629	0.510	0.098*** (0.034)

Notes: Authors' calculations from NSFG and MES data. Reported in the first two columns are the unconditional means of each dependent variable for the samples of male and female children. The third column reports the estimated coefficient on the male binary indicator in a regression including the control variables described in the appendix. Robust standard errors in parentheses. One star indicates significance at the 10 percent level; two stars for 5 percent; three stars for 1 percent.

Table 8: **Mothers' Time Inputs Promoting Cognition, UK—Twins**

	Males	Females	Difference
Age 3			
Reading (mother)	4.990	5.050	-0.061
			(0.112)
Teach Alphabet	3.243	3.425	-0.182
			(0.171)
Teach Counting	5.360	5.776	-0.215
			(0.183)
Teach Songs	6.098	6.418	-0.300**
			(0.129)
Paint (PMK)	4.884	5.297	-0.413***
			(0.182)
How often goes to library	1.449	1.522	-0.074
			(0.089)

Notes: Authors' calculations from MCS data. Reported in the first two columns are the unconditional means of each dependent variable for the samples of male and female children. The third column reports the estimated coefficient on the male binary indicator in a regression including the control variables described in the appendix. Robust standard errors in parentheses. One star indicates significance at the 10 percent level; two stars for 5 percent; three stars for 1 percent.

Table 9: Reading Frequency in samples split by Mothers' Characteristics—First Born

	US Age 2 years	Canada Age 3-4 Years	UK Age 3 years
Mothers' Education			
Mother HSG or less	-0.084	-0.056	-0.121***
	(0.057)	(0.091)	(0.043)
Mother more than HSG	-0.127***	-0.187***	-0.065**
	(0.041)	(0.048)	(0.030)
Mothers' Employment			
Mother works	-0.083*	-0.177***	-0.104***
	(0.045)	(0.051)	(0.033)
Mother doesn't work	-0.122**	-0.056	-0.062
	(0.052)	(0.077)	(0.051)
Mothers' Marital Status			
Mother Married	-0.065	-0.153***	-0.019
	(0.040)	(0.045)	(0.031)
Mother Single	-0.177***	-0.031	-0.178***
	(0.060)	(0.137)	(0.053)
Mothers' Age at Birth			
Mother <35	-0.123***	-0.125**	-0.080***
	(0.036)	(0.051)	(0.031)
Mother 35+	-0.111	-0.228***	-0.170**
	(0.113)	(0.077)	(0.085)
Mothers' Place of Birth			
Mother foreign Born	-0.253***	-0.203	0.199
	(0.080)	(0.127)	(0.164)
Mother native born	-0.081**	-0.149***	0.103***
	(0.038)	(0.043)	(0.029)

Notes: Authors' calculations from ECLS-B data for United States, NLSCY for Canada, and MCS for United Kingdom. The rows in this table define different samples on which the regression is run. The dependent variable is indicated for each country. Each entry in the table reports the estimated coefficient on the male binary indicator in a regression including the control variables described in the appendix. Robust standard errors in parentheses. One star indicates significance at the 10 percent level; two stars for 5 percent; three stars for 1 percent.

Table 10: Analysis of Quebec Universal Childcare – First Born

	Male Sample		Female Sample		Pooled Sample	
	POST	POST*QUE	POST	POST*QUE	POST*QUE	POST*QUE * Male
Age 0-1						
Mother Works	0.069**	0.075***	0.059	0.090***	0.073**	0.020
	(0.029)	(0.019)	(0.035)	(0.023)	(0.029)	(0.026)
Age First Book	-1.748***	-0.009	-1.741***	0.200	0.141	-0.005
	(0.304)	(0.247)	(0.184)	(0.144)	(0.117)	(0.081)
Reading	0.362***	0.187***	0.328***	0.046	0.070**	0.099**
	(0.039)	(0.033)	(0.043)	(0.048)	(0.028)	(0.042)

Notes: Authors' calculations from NLSCY data.
Reported are the estimated coefficients on the indicated variables for the indicated samples. The other control variables included in the regressions are listed in the Appendix. Robust standard errors in parentheses. One star indicates significance at the 10 percent level; two stars for 5 percent; three stars for 1 percent.

Table 11: The Relationship between Cognitive Inputs and Developmental Outcomes

	Conditional Difference	Conditional on Cognitive Inputs Difference
Panel A: United States		
Reading Score at 4 years		
Inputs measured at 9 months	-1.853***	-1.769***
	(0.454)	(0.449)
Inputs measured at 2 years	-1.850***	-1.431***
	(0.454)	(0.451
Math Score at 4 years		
Inputs measured at 9 months	-1.228***	-1.162**
	(0.390)	(0.388)
Inputs measured at 2 years	-1.225***	-0.913**
	(0.390)	(0.389)
Panel B: Canada		
PPVT At Ages 4-5		
Inputs measured in first interview	-2.436***	-2.327***
	(0.739)	(0.712)
Inputs measured in previous wave	-2.419**	-1.560*
	(1.012)	(0.908)
KYN At Ages 4-5		
Inputs measured in first interview	-0.066***	-0.063***
	(0.025)	(0.024)
Inputs measured in previous wave	-0.060*	-0.036
	(0.037)	(0.034)
Panel C: United Kingdom		
Picture Similarity Score		
Inputs measured at 3 years	-1.513***	-1.282***
	(0.344)	(0.357)
Naming Vocabulary Score		
Inputs measured at 3 years	-0.300	-0.112
	(0.425)	(0.438)
Pattern Construction Score		
Inputs measured at 3 years	-2.399***	-2.030***
	(0.548)	(0.571)

Notes: Authors' calculations from ECLS-B data for United States, NLSCY for Canada, and MCS for United Kingdom. Reported is the coefficient on the male binary indicator in a regression including the control variables described in the appendix. The last column repeats the regression but includes the cognitive inputs reported in tables 4, 5, and 6 as control variables. Robust standard errors in parentheses. One star indicates significance at the 10 percent level; two stars for 5 percent; three stars for 1 percent.